MEMORANDUM

TO: Eatonville Town Council
FROM: Nicholas Bond
SUBJECT: Water Use Efficiency Rule
DATE: December 4, 2012

At issue

In September 2003, the Washington State Legislature passed the Municipal Water Supply – Efficiency Requirements Act, also known as the Municipal Water Law. The Municipal Water Law requires the state to implement the Water Use Efficiency Rule. The intent of this rule is to help reduce the demand that growing communities, agriculture, and industry have placed on the state's water resources, and to better manage these resources for fish and other wildlife. Municipal water suppliers are obligated under the WUE Rule to enhance the efficient use of water by the system and/or its consumers. The requirements of the WUE Rule are set forth in Chapter 246-290 of the Washington Administrative Code (WAC), Part 8.

The WUE Rule applies to all municipal water suppliers and requires suppliers to:

- Develop WUE goals through a public process and report annually on their performance;
- Meet distribution system leakage standards based on a 3-year rolling average at or below 10 percent of production;
- Meter all existing and new service connections;
- Collect production and consumption data, calculate distribution system leakage, and forecast demands;
- Evaluate WUE measures; and
- Implement a WUE program.

Recommendations

In order to comply with the water use efficiency rule, the town council is required to conduct a public hearing on Water Use Efficiency goals prior to their adoption. Once adopted, the town's consultant will move forward to complete the town's Water System Plan. By conducting a public hearing on the two sections of the proposed water system plan which are attached and by making a motion to to formally adopt the Water Use Efficiency goals presented in the draft Eatonville Water System Plan as required by the Water Efficiency Rule, the town Council can satisfy the above requirements.

Water Use Efficiency Program

INTRODUCTION

The Town of Eatonville (Town) recognizes that water is a valuable and essential natural resource that needs to be used wisely. This Water Use Efficiency (WUE) program provides an approach to increase water use efficiency within the Town's water service area.

BACKGROUND

The Water Use Efficiency Rule

In September 2003, the Washington State Legislature passed the Municipal Water Supply – Efficiency Requirements Act, also known as the Municipal Water Law. The Municipal Water Law requires the state to implement the Water Use Efficiency Rule. The intent of this rule is to help reduce the demand that growing communities, agriculture, and industry have placed on the state's water resources, and to better manage these resources for fish and other wildlife. Municipal water suppliers are obligated under the WUE Rule to enhance the efficient use of water by the system and/or its consumers. The requirements of the WUE Rule are set forth in Chapter 246-290 of the Washington Administrative Code (WAC), Part 8.

The WUE Rule applies to all municipal water suppliers and requires suppliers to:

- Develop WUE goals through a public process and report annually on their performance;
- Meet distribution system leakage standards based on a 3-year rolling average at or below 10 percent of production;
- Meter all existing and new service connections;
- Collect production and consumption data, calculate distribution system leakage, and forecast demands;
- Evaluate WUE measures; and
- Implement a WUE program.

Water Use Efficiency Program Requirements

The *Water Use Efficiency Guidebook,* originally published by the Washington State Department of Health (DOH) in July 2007 and revised in January 2011, identifies the water use reporting, forecasting and efficiency program requirements for public water systems. A WUE program meeting these requirements is a necessary element of a water system plan as required by the DOH and is necessary to obtain water right permits from the Washington State Department of Ecology

(Ecology). The *Water Use Efficiency Guidebook* defines the necessary components of a WUE program as the following three fundamental elements.

1. Planning requirements that include collecting data, forecasting demand, evaluating WUE measures, calculating distribution system leakage, and implementing a WUE program to meet goals.
2. A distribution system leakage (DSL) standard of 10 percent or less based on a 3-year rolling average.
3. Goal setting to provide a benchmark for achievement and to help define the success of the WUE program, as well as annual performance reporting on progress towards meeting WUE goals.

WATER SUPPLY CHARACTERISTICS

Water supply to the Town's water system is provided by the Mashel River and four wells adjacent to the river. The wells draw from an unconfined aquifer and are considered a well field under the direct influence of surface water. A summary of the sources is shown in **Table 1**, and a more detailed description of each source of supply is provided in **Chapter 2** of the Town's 2012 Comprehensive Water System Plan (WSP).

Table 1
Supply Facilities Summary

Source	Pressure Zone	Year Drilled	Existing Capacity (gpm)	Well Depth (feet)	Well Diameter (inches)	Pump Type	Pump Motor Size (hp)	Water Treatment[1]	Control Facility
Mashel River	996 Zone	n/a	400	n/a	n/a	n/a	n/a	MF/Cl_2/NaOH	Clear Wells
Well No. 1	996 Zone	1966	210	43	12	Submersible	5	MF/Cl2/NaOH	Clear Wells
Well No. 2	996 Zone	1969	220	44	10	Submersible	5	MF/Cl2/NaOH	Clear Wells
Well No. 6	996 Zone	2004	200	73.5	12	Submersible	7.5	MF/Cl2/NaOH	Clear Wells
Well No. 7	996 Zone	2004	325	99	12	Submersible	15	MF/Cl2/NaOH	Clear Wells

1 = MF: membrane filtration; Cl_2: chlorination; NaOH: caustic soda for pH

The Town currently holds several water right permits and certificates for the supply facilities shown in **Table 1**. A summary of these water rights is presented in **Table 2**. The Town has acquired water right certificates for all of the sources shown in **Table 1**. Additional water rights information for each source may be found in **Chapter 6** of the WSP, as well as on the certificates, permits, and water rights self assessment, which are included in **Appendix J** and **Appendix P** of the WSP.

Table 2
Existing Water Rights

DOH No.	Source Name	Permit or Certificate Number	Priority Date	Primary or Supplemental Right	Existing Water Rights			
					Instantaneous		Annual	
					(gpm)	(cfs)	(acre-ft)	(gpm)
S05	Mashel River	10307 and S2-004455CL	8/18/1967 6/1908	Both No	1,032	2.3	525	325
S06	Well Nos. 1, 2, 6 & 7	5676-A	11/29/1966	Both	360	0.8	394	244
S06	Well Nos. 1, 2, 6 & 7	G2-01087C	8/18/1967	Supplemental	250	0.6	400	247
Totals					1,642	3.7	525	325

The Mashel River is within the Nisqually River Basin, which is Water Resources Inventory Area (WRIA) 11. Water use within this basin is regulated by Ecology. In 1981, Ecology adopted an administrative rule titled, "Instream Resources Protection Program – Nisqually River Basin, Water Resource Inventory Area 11", which is Chapter 173-511 WAC. This rule established minimum instream flows at specific control stations on the larger rivers in the basin. The minimum instream flows are in effect a non-consumptive water right held by the state, on behalf of the public, for maintaining water in a river for in-stream uses of water. The priority date of these minimum instream flow rights is the date the rule specifying them was adopted (February 2, 1981, for Chapter 173-511 WAC). Since the Town's existing water rights were issued prior to the adoption of the instream flow rule, which means the Town's rights are senior, they are not subject to these minimum instream flows. However, if the Town decides to apply for a new water right for additional water supply, that water right would be younger (junior) than the minimum instream flow rule and would therefore be subject to the rule. Being subject to a minimum instream flow means that a water right holder cannot reduce the flow of the river when the minimum instream flows are not being met. For a surface water diversion or groundwater in direct hydraulic continuity with the river, water could only be captured when the actual flow in the river exceeds the minimum instream flows set in the rule for that particular day.

The sources of supply are not located in any of the 16 fish-critical basins established by Ecology. The Nisqually Chinook Recovery Plan has identified restoration and protection projects for the Mashel River to improve habitat conditions for Chinook salmon, a species designated under the Endangered Species Act as Threatened in the Nisqually basin. The Phase IV Nisqually Implementation Plan for Watershed Management in WRIA 11 recommends surface water augmentation to increase instream flows in the Mashel River for fish habitat. The Town is currently preparing an Alternative Water Source Investigation that includes analyses regarding altering the use of current supply sources to increase instream flow in accordance with the watershed management goals.

Environmental factors such as drought or climate change are likely to affect recharge to the sources since flow in the Mashel River is predominately rainfall dependent. Levels in the Mashel River are highest in the winter months and lowest in the summer months. The Town must rely on both the wells and river source in the summer months to meet peak demands. The river source is rarely used at other times of the year due to high turbidity and the increased levels of treatment required.

WATER USE EFFICIENCY PROGRAM

As previously described, the fundamental elements of a WUE program include planning requirements and DSL standards, as well as goal setting and performance reporting. The Town's water use data, demand forecasts and other planning requirements are contained in **Chapter 4** of the WSP. The Town is committed to continue collecting water use data beyond that presented in **Chapter 4** for evaluation of its WUE program and water use patterns, and for forecasting demands for future facilities. The Town's WUE program that follows includes a statement of its goals and objectives, the evaluation and selection of alternative efficiency measures, the schedule and budget, and the method of program monitoring.

Water Use Efficiency Goals and the Public Process

Per WAC 246-290-830, WUE goals must be set through a public process and must be evaluated and reestablished a minimum of every 6 years. In compliance with the WUE Rule, a public hearing was held during the summer of 2009 to present and discuss the Town's initial goals. The initial WUE goals included reducing overall water demand and reducing the distribution system leakage to 10 percent or less. As is evident in **Chapter 5** of the WSP, the Town successfully reduced the overall water system demand from 132 gallons per capita per day in 2009 to 120 gallons per capita per day in 2011. The Town achieved an overall water savings of approximately 8.8 million gallons of water over the previous 2 years when most of the water savings for the 6-year planning period was realized. The goal of reducing the distributions system leakage to 10 percent or less has not been achieved since the goal was established.

New goals have been proposed based on the demand analysis and projections presented in the Town's WSP. The proposed goals and objectives of the Town's WUE program consist of:

- Reducing the four-year rolling average per capita demands by 6 percent by 2018, and by 8 percent by 2032; and
- Reducing DSL to 10 percent or less by 2015.

As a part of the water system planning process, a public hearing was held on December 10, 2012, to present and discuss the newly established proposed goals. Background information on the Town's proposed WUE program, water supply characteristics, water demand forecasts, and other elements were made available 2 weeks prior to the public forum date. All comments received at the forum were reviewed and considered by the Town. It is anticipated that the proposed goals will be adopted, along with the WSP, at a regularly scheduled Town Council meeting. In the future, WUE goals will be evaluated and reestablished during the water system planning process, or at minimum of every 6 years.

The Town will achieve these goals and objectives through the implementation of the WUE program that follows. Reducing DSL is a supply side goal that can be achieved through measures that will mainly be carried out by the Town's Water Department, or in coordination with other Town departments. Reducing the demand per capita is a demand side goal that can be achieved through carrying out measures that affect customers' water use.

Evaluation and Selection of Water Use Efficiency Measures

The Town's evaluation of WUE measures and selected levels of implementation are presented within this section. The measures fall within three categories of implementation: 1) mandatory measures that must be implemented; 2) measures that must be evaluated; and 3) additional measures selected by the Town that must be either evaluated or implemented.

The Town served 1,036 water service connections in 2011. Based on the number of connections, at least five WUE measures must be evaluated or implemented. Measures that are mandatory cannot be credited towards the system's WUE measures. Since the Town implements the minimum number of required measures, a cost-effective evaluation is not required.

Mandatory Measures

Source Meters

The volume of water produced by the system's sources must be measured using a source meter or other meter installed upstream of the distribution system. Source meters are currently installed and operating at each of the Town's sources. If any new sources are installed in the future, they will be equipped with a source meter.

Service Meters

All public water systems that supply water for municipal purposes must install individual service meters for all water users. Service meters are currently installed and operating at all connections throughout the distribution system. All future connections that are installed or activated will be equipped with a service meter.

Meter Calibration

The Town must calibrate and maintain meters based on generally accepted industry standards and manufacturer information. Compliance will be maintained by the Town by performing maintenance on the source and service meters every 5 to 10 years at a minimum. Meter calibration is performed on an as-needed basis, typically when meter readings are inconsistent with customer consumption history.

Water Loss Control Action Plan

To control leakage, systems that do not meet the DSL standard must implement a Water Loss Control Action Plan (WLCAP). The Town's rolling 3-year average DSL was 16 percent in 2011; therefore a WLCAP is required. The Town has set a goal to reach a DSL of 10 percent or less by 2015. The Town has periodically seen DSL at 10 percent or less when active leak detection and repair is in progress. The Town plans to pursue an aggressive system-wide leak detection and repair program to meet its goal. Leak detection will be performed by professional contractors and the

Town's employees and repair of the leaking water mains will be completed as soon as possible. Further training of water and fire department employees will also be done to ensure the Town's personnel are properly trained regarding complete closure of older fire hydrants. The Town will continue to look for unauthorized water users and to ensure that water sales are recorded in the proper units. The Town takes the DSL issue very seriously and plans to utilize available resources to reduce the DSL percentage.

Customer Education

Annual customer education regarding the importance of using water efficiently is a required element of all WUE programs. Customer education is provided in the Town's annual Consumer Confidence Report (CCR) to customers and includes information on the system's DSL and progress towards meeting WUE goals. A copy of the Town's 2011 CCR is located in **Appendix M** of the WSP.

Measures That Must Be Evaluated

Rate Structure

A rate structure that encourages WUE and provides economic incentives to conserve water must be evaluated, but is not required to be implemented. The Town's current utility rates are designed to discourage excessive water use. New water rates were evaluated in the Town's 2005 Rate Study. The Town implemented a two-tiered inclining block rate structure to encourage WUE. For ¾-inch meters serving single-family residences, the inclining block rate structure imposes a charge of $0.34 for every hundred gallons over 15,000 gallons. This is an increase from the base amount of $0.24 charged per hundred gallons for 0 to 15,000 gallons. The usage rates are in addition to the single-family base rate of $28.00. Future rate studies will consider a more aggressive inclined block rate structure and an evaluation of seasonal rates to reduce peak summer water use.

Reclamation Opportunities

The Town has evaluated reclamation opportunities, but has determined that reuse opportunities are currently not feasible. The Town has installed purple pipe, which is pipe typically used for reclaimed water, at various locations throughout the Town, but the network is incomplete. Furthermore, the existing wastewater treatment plant does not have the ability to treat wastewater to an acceptable standard for reclaimed purposes. Significant upgrades to the wastewater treatment plant and the installation of substantial lengths of purple pipe would be necessary to provide reclaimed water to customers.

If the wastewater treatment facility was upgraded to treat wastewater to an acceptable standard, the Town would need to obtain a reclaimed water use permit to put reclaimed water to a beneficial use. One of the most difficult hurdles to obtaining a reclaimed water use permit is the water right impairment analysis. Under this analysis, the impact of reducing the amount of wastewater discharge is viewed similarly to a new consumptive water right from the Mashel River and the reclaimed water permit can only be granted if there is no impairment of any other water right holder, including minimum instream flows. The potential for not meeting instream flows throughout the year exists for the Mashel River, and closing the river from June 1 to October 31 would prevent reclaimed water from being used during this period. Unfortunately, this is the same period when the Town would logically be looking for reclaimed water supply to offset or cover irrigation demand, which

accounted for approximately 10 percent of the Town's billed consumption in 2011. Outside of the summer months, when the reclaimed water could be stored or utilized, there is likely minimal demand for a water supply that cannot be put to potable uses.

Due to the difficulty associated with obtaining a reclaimed water use permit for summer water use and the high cost of upgrading the wastewater treatment plant and purple pipe network, additional reclamation opportunity investigations will not be completed by the Town at this time.

Selected Measures

The Town has chosen to implement four different WUE measures in addition to those that are mandatory or required to be evaluated. Each of the chosen measures will be implemented for the two primary customer classes (i.e., the single-family class and the multi-family/commercial/school class). The Town's WUE program, therefore, counts as eight WUE measures, which exceeds the requirement of five WUE measures based on the number of service connections.

Conservation Rate Structures

Evaluating rate structures to increase water demand efficiency is required per WAC 246-290-100(4)(J)(iv), but actually implementing of a conservation rate structure counts as a WUE measure per WAC 246-290-810(4)(d). The Town is implementing an inclining block rate structure for its customers. Since this measure is implemented for all customer classes, it counts as two WUE measures for the Town's program.

Notifying Customers About Leaks on Their Property

Notifying customers of unusually high water bills potentially caused by a leak on the customer's property counts as a WUE measure per WAC 246-290-810(4)(f). When the Town's meter reader notices an unusually high meter reading, the Town contacts the property owner and advises the customer to search for leaks. Since the Town notifies customers in all customer classes of unusual high meter readings, it counts as two WUE measures for the Town's program.

Customer Education

Customer education that is carried out more than once a year counts towards meeting the program requirements for WUE measures. The Town will provide periodic customer education, in addition to the annual CCR, by periodically posting water tips on the Town's Facebook page. Since this measure is being implemented for all customer classes, it counts as two WUE measures for the Town's program.

Water Bill Showing Consumption History

The Town will continue to provide all of their customers with consumption history and will include conservation messaging on water bills. If implemented, this will count as two additional WUE measures for the Town's program.

Water Use Efficiency Program Schedule and Budget

The WUE measures described in the previous section and selected for implementation by the Town are summarized in **Table 3** with their corresponding schedule and budget. The successful implementation of this program is expected to achieve a 6 percent per capita water use reduction by the year 2018 and an 8 percent per capita water use reduction by the year 2032, as shown in **Chart 1**.

Table 3
WUE Program Schedule and Budget

Water Use Efficiency Measure	Schedule	Budget
Mandatory Measures		
Source Meters	Ongoing	O&M Funded
Service Meters	Ongoing	O&M Funded
Meter Calibration	Ongoing	O&M Funded
Water Loss Control Action Plan/Leak Detection[1]	Ongoing	$1,000/yr
Customer Education - Annual Consumer Confidence Report	Ongoing	$1,000/yr
Measures That Must be Evaluated		
Rate Structure[2]	2016	$40,000
Selected Measures		
Notifying Customers About Leaks on Their Property	Ongoing	O&M Funded
Customer Education - Facebook Tips	Ongoing	O&M Funded
Water Bill Showing Consumption History	Ongoing	O&M Funded

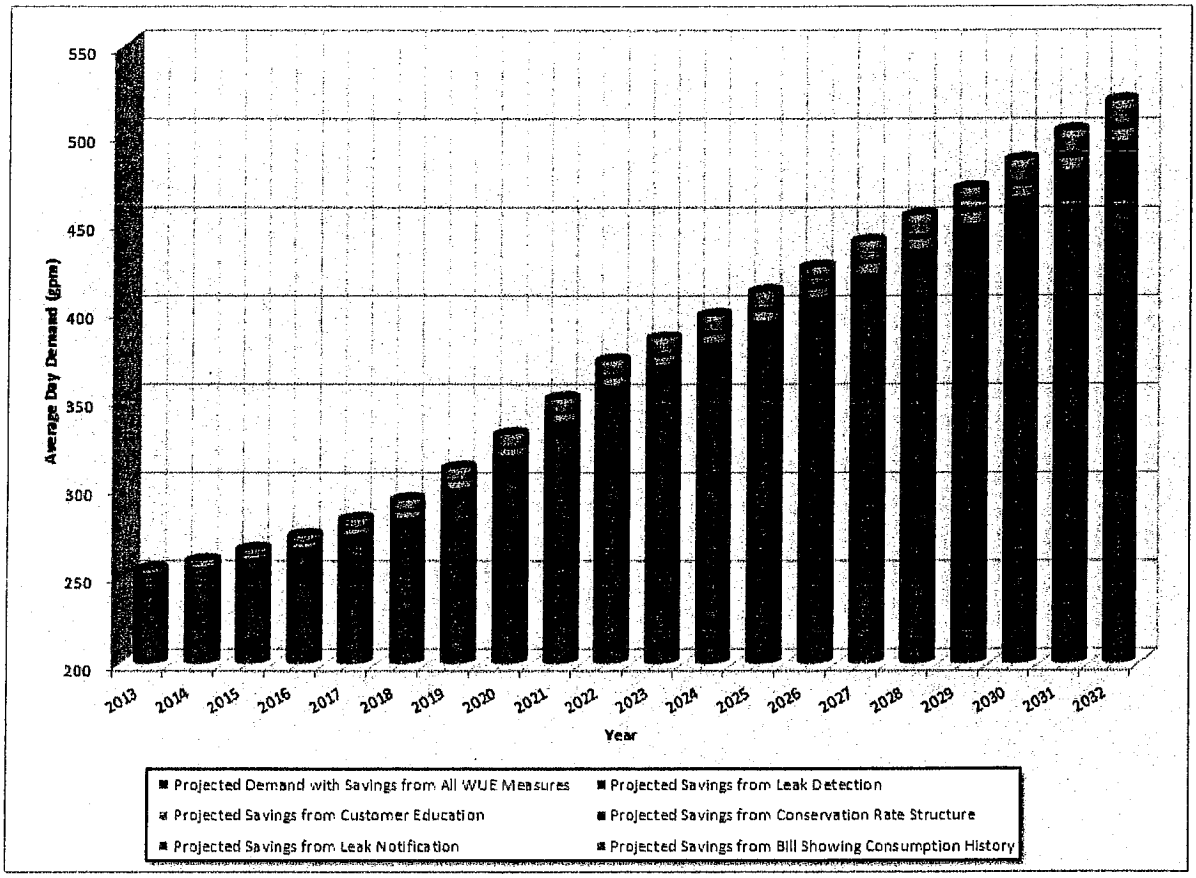
1 = When the Town's budget allows, additional resources will be utilized for leak detection.
2 = Rate structure budget reflects estimated water rate study cost.

Water Use Efficiency Program Evaluation and Reporting

The Town will continue to evaluate overall demand, per capita and per ERU water use, and the amount of DSL on an annual basis. The Town will evaluate the performance of its WUE program and implemented measures by analyzing demand data and determining the long-term trend towards reducing water usage per capita and meeting WUE goals. If the program monitoring shows that progress towards meeting the WUE goals is not being accomplished, more rigorous program implementation or additional program items will be considered, along with a cost-effective evaluation of measures.

The Town will continue to provide annual WUE performance reports to its consumers in the CCR, and will detail the results of water use monitoring and progress towards achieving the system's WUE goals. A copy of the Town's 2011 CCR is included in **Appendix M** of the Town's WSP.

Chart 1
WUE Program Projected Water Savings



Water Demands

4

INTRODUCTION

A detailed analysis of water system demands is crucial to the planning efforts of a water supplier. A demand analysis first identifies current demands to determine if the existing system can effectively provide an adequate quantity of water to its customers under the most crucial conditions, in accordance with federal and state laws. A future demand analysis identifies projected demands to determine how much water will be needed to satisfy future growth of the water system and continue to meet federal and state laws.

Demands on the water system determine the size of storage reservoirs, supply facilities, water mains, and treatment facilities. Several different types of demands were analyzed and are addressed in this chapter, including average day demand (ADD), peak day demand (PDD), peak hour demand (PHD), fire flow demand, future demands, and a water use efficiency demand reduction forecast.

The magnitude of water demands is typically based on three main factors: 1) population, 2) weather, and 3) water use classification. Population and weather have the two largest impacts on water system demands. Population growth has a tendency to increase the annual demand; whereas, high temperature has a tendency to increase the demand over a short period of time. Population does not solely determine demand, because different populations use varying amounts of water. The use varies based on the number of users in each type of customer class, land use density, and irrigation practices. Water conservation efforts will also impact demands and can be used to accommodate a portion of system growth without increasing a system's supply capacity.

Certificate of Water Availability

In accordance with the requirements of the Growth Management Act (GMA), the Town of Eatonville (Town) must identify that water is available prior to issuing a building permit. A "Certificate of Water Availability" (CWA) is issued if there is sufficient water supply to meet the domestic water service and fire flow requirements of the proposed building. The requirement for providing evidence of an adequate water supply was codified in 1990 under Title 19.27.097 of the Revised Code of Washington (RCW) in the Building Code Section. To assist governments with implementing these requirements, the Department of Health (DOH) has developed a handbook titled *Guidelines for Determining Water Availability for New Buildings.*

CURRENT POPULATION AND SERVICE CONNECTIONS

Residential Population Served

The population within the Town limits was 2,775 in 2011. The Town serves water to approximately 21 customer connections outside of the Town limits along Eatonville Highway and near the intersection of Hilligoss Lane and 428th Street East. At approximately 2.78 people per residence, an estimated 60 additional people are served outside of the Town limits.

In 2011, the Town provided water service to an average of 1,036 customer accounts, of which approximately 870 or 84 percent of these accounts were single-family residential customers, 160 accounts or 15 percent were multi-family residential, schools, commercial and other customers, and 6 accounts or 1 percent were fire hydrants and fire sprinklers.

Water Use Classifications

The Town has divided all water customers into categories based on water meter size and customer class for billing purposes. For planning purposes, the water customers have been distributed into three different groups – single-family residential; multi-family residential, schools, commercial and other; and fire sprinklers and fire hydrants. The demand analysis that follows will report on the water use patterns of these three user groups.

EXISTING WATER DEMANDS

Water Consumption

Water consumption is the amount of water used by all customers of the system, as measured by the customers' meters. **Table 4-1** shows the historical average number of connections, average annual consumption, and average daily consumption per connection of each customer class for the Town from 2008 through 2011. Data between 2004 and 2007 was unavailable due to a new billing system that was introduced in mid-2007.

As shown in **Chart 4-1**, the single-family residential class represents approximately 84 percent of all connections, but only 70 percent of total system consumption, as shown in **Chart 4-2**. This is due to the lower consumption per connection of the single-family residential customers as compared to the other customers. As shown in **Table 4-1,** the single-family residential customers use an average of approximately 177 gallons per day (gpd) per connection, compared to the multi-family, school, commercial and other customers that use an average of approximately 407 gpd per connection, and the fire sprinkler and fire hydrant customers that only use water occasionally. The higher consumption of non-single family customers is expected, since these customers include multi-family residential customers where one connection typically serves several units, and commercial customers that include the system's highest individual water users.

Table 4-1
Average Annual Metered Consumption and Service Connections

Year	Customer Class			Totals
	Single Family	Multi-Family, Schools, Commercial, Other	Fire Sprinklers, Hydrants	
Average Number of Connections				
2008	865	161	6	1,032
2009	881	156	6	1,043
2010	874	157	6	1,037
2011	870	160	6	1,036
Average Annual Consumption (1000 gals)				
2008	60,488	25,120	0	85,608
2009	66,269	25,098	0	91,367
2010	58,970	23,226	0	82,196
2011	56,290	23,743	0	80,034
Average Daily Consumption Per Connection (gal/day/conn)				
2008	192	428	0	
2009	206	441	0	
2010	185	406	0	
2011	177	407	0	

The general decline in average annual consumption from 2008 to 2011 for all customer classes is shown in **Table 4-1**. In 2011, the single-family residential customers used an average of 8 percent less water than in 2008. The customer class consisting of multi-family residential, schools, commercial and other users also shows a decreasing trend in water consumption per connection. The decline in consumption is likely due to the Town's water use efficiency efforts.

Chart 4-1
2011 Water Connections by Customer Class

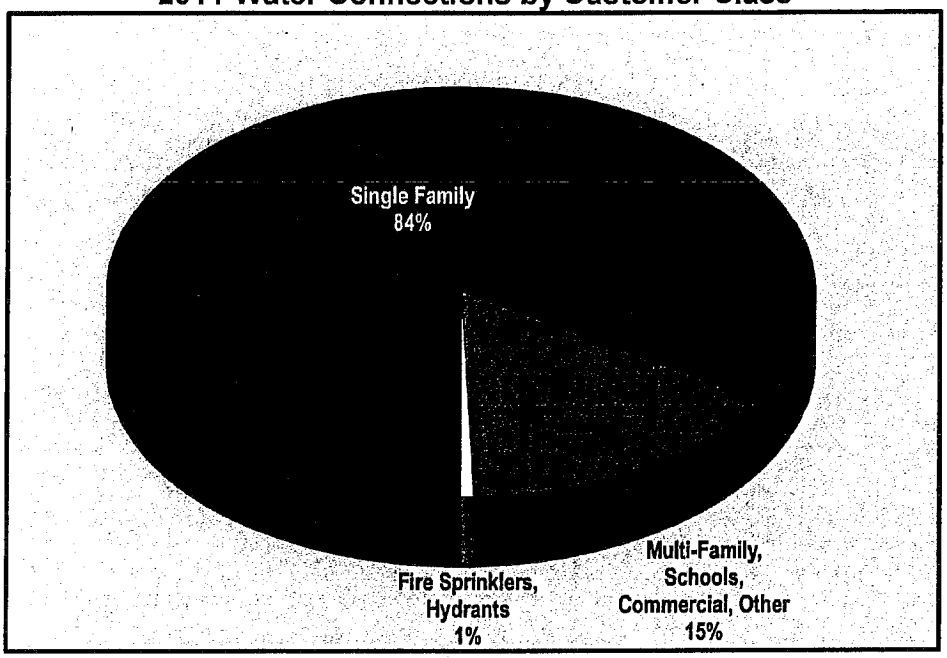


Chart 4-2
2011 Water Consumption by Customer Class

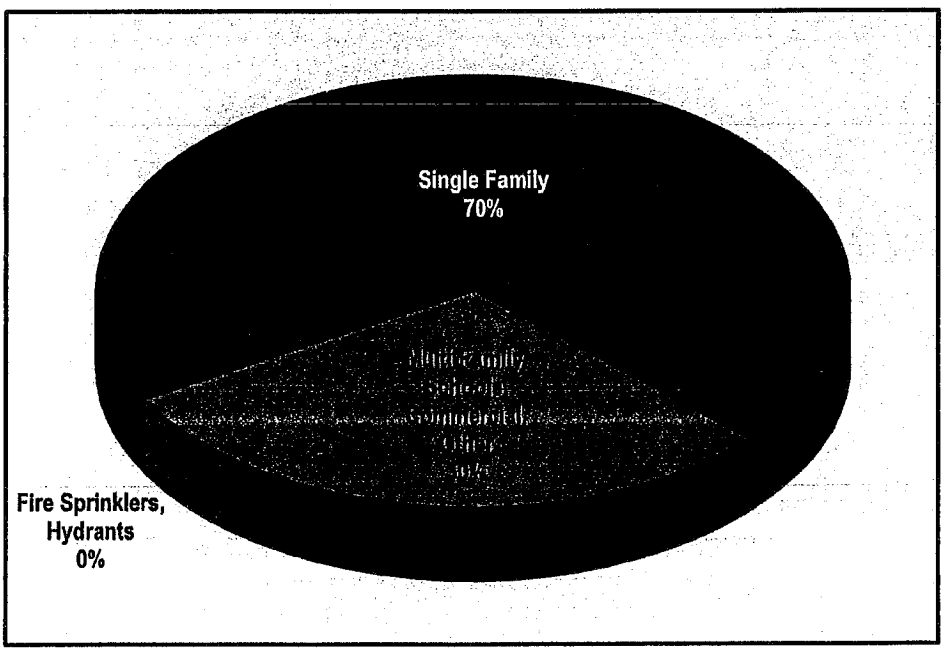


Table 4-2 shows the largest water users of the system in 2010 and their total amount of metered consumption for the year. The total water consumption of these 11 water accounts represented approximately 15 percent of the system's total consumption in 2010. The list of accounts in the table consists of schools, multi-family residences, commercial facilities, the sewer treatment plant, and a church. In 2011 a leak was found at Keybank, the fourth largest water user in 2011. The fix was repaired in 2011 and Keybank is no longer one of the largest water users in the system.

Table 4-2
2010 Largest Water Users

Name	Address	Yearly Consumption (gals)
Eatonville School District Irrigation	209 Washington Ave N	3,423,969
Town of Eatonville Sewer Plant	370 Mashell Ave S	2,140,000
Nybo Redi Mix Concrete	675 Center St E	1,091,900
Keybank	101 Center St W	922,610
Eatonville School District Sprinkler	302 Mashell Ave N	859,800
Eatonville School District Gym	302 Mashell Ave N	828,100
Malcom's Laundromat	320 Center St E #A4	735,850
Glacier Village Apartments	212 Glacier Ave N	707,000
Daka Inc. Apartments	206 Carter St E	633,300
Westwood (John Hightower)	815 Eatonville Hwy W	624,830
Eatonville Baptist Church	825 Eatonville Hwy W	618,500
Largest Water Users Total		12,585,859
Water System Total		82,195,951
Percent of Total		15%

Demand for residential and commercial customers varies throughout the year, typically peaking in the hot summer months. Residential and commercial customers often peak at different times or have different peaking factors because their uses differ. The demand for single-family residential customers in the Town generally peaks in August as shown in **Chart 4-3**. For the Town, the demand for the multi-family residential, schools, commercial and other customers also peaks in August, as shown in **Chart 4-4**. However, the peak month consumption versus average month consumption factor for multi-family residential, schools, commercial and other customers in the Town's water system is slightly higher than the peak month consumption versus average month consumption factor for single family residential customers, indicating that the non-single family class experiences slightly higher peaks than the single family class as indicated in **Chart 4-5**. The WUE Program in **Appendix F** will evaluate the potential water savings available from the customer classes with the higher peaking factor.

Chart 4-3
Historical Monthly Single-Family Consumption

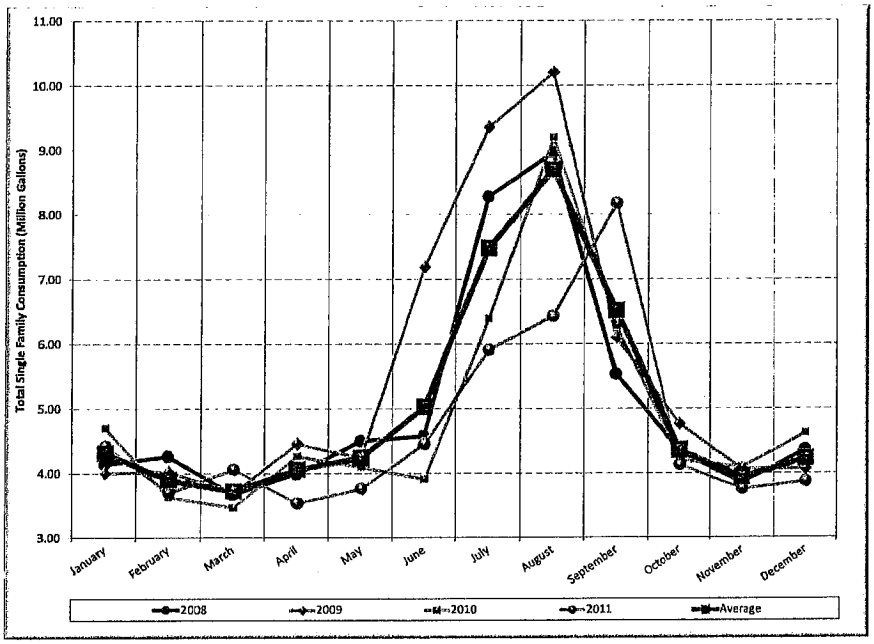


Chart 4-4
Historical Monthly Non-Single Family Consumption

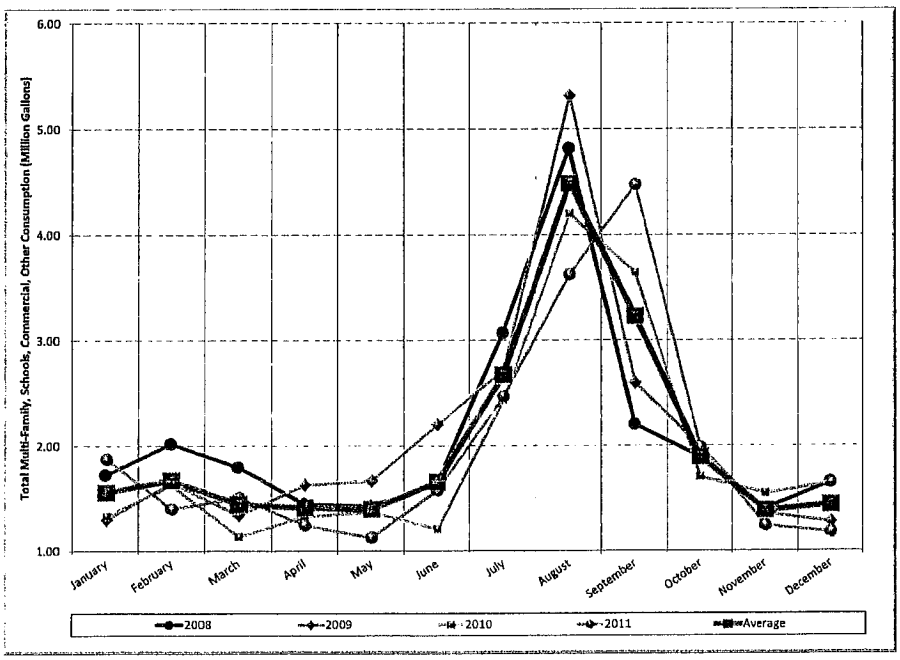
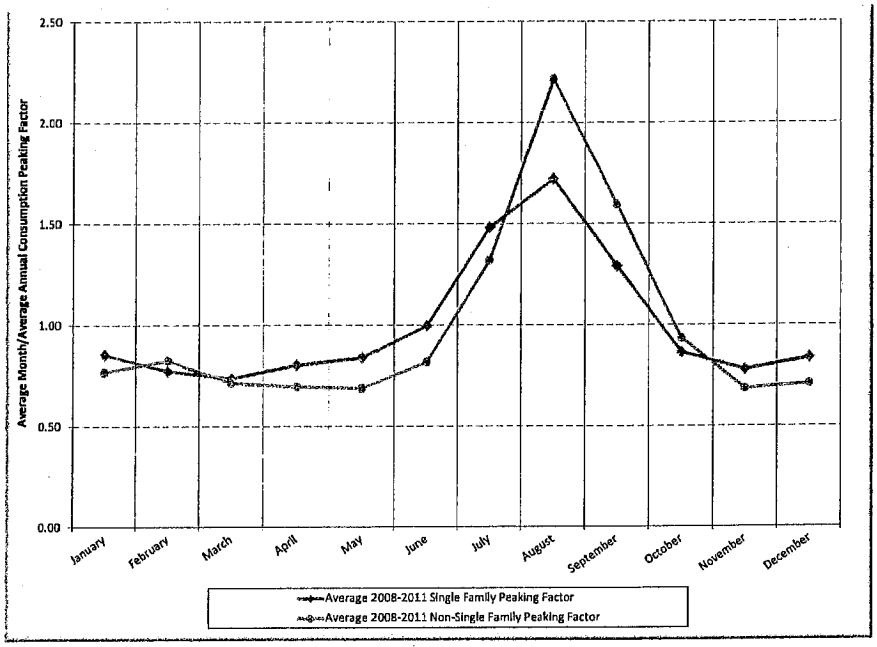


Chart 4-5
Average Monthly Peaking Factors by Customer Class



Water Supply

Water supply, or production, is the total amount of water supplied to the system, as measured by the meters at each supply source. Water supply is different than water consumption in that water supply is essentially the recorded amount of water put into the system, and water consumption is the recorded amount of water taken out of the system. The measured amount of water supply in any system is typically larger than the measured amount of water consumption, due to non-metered water use and water loss (i.e., distribution system leakage). **Table 4-3** summarizes the total amount of water supplied by the sources for 2004 through 2011 and the calculated ADD for each year.

Table 4-3
Historical Water Supply and System Demand

Year	Population in Town Limits	Population Outside Town	Total Population Served	Annual Supply (gal)	Average Daily Demand (gpm)	Average Demand Per Capita (gpd)
2004	2,310	60	2,370	106,102,043	202	123
2005	2,385	60	2,445	109,419,274	208	123
2006 [1]	2,460	60	2,520	126,053,920	240	137
2007	2,534	60	2,594	164,323,600	313	174
2008	2,609	60	2,669	126,539,000	241	130
2009	2,683	60	2,743	132,585,000	252	132
2010	2,758	60	2,818	132,098,000	251	128
2011	2,775	60	2,835	123,773,000	235	120
Average 2008 - 2011						128

1 = River supply data is missing for 2006 and the annual supply quantity is lower than the actual amount supplied.

In general, the Town experienced a trend of increasing water supply, or system-wide water demand between 2004 and 2007, as shown in **Table 4-3**, due to system-wide growth and the associated increase in water usage. The decline between 2007 and 2011 is likely due to water use efficiency practices, the replacement of old water mains, and the repair of water main leaks to decrease water supply. The ADD has remained relatively steady for the last 4 years.

Table 4-3 also presents the computation of the demand per capita for 2004 through 2011. Although the average demand per capita has fluctuated, the average demand per capita for the last 4 years is 128 gpd, which is a 16 percent reduction from the average demand per capita of 153 gpd per capita reported in the previous Water System Plan (WSP). The average per capita demand is used later in this chapter to forecast water demands in future years, based on future population estimates.

Table 4-4 shows the average demand of each of the Town's pressure zones, based on 2011 master meter data. The master meter supply data in Table 4-4 was used for the existing demands in the hydraulic model. The total master meter supply data in **Table 4-4** is less than the annual supply in **Table 4-3** due to water usage for treatment purposes and potential leakage between the sources of supply and the master meter, which will be discussed later in this chapter.

Like most other water systems, the Town's water supply varies seasonally. **Chart 4-6** shows the historical amount of water supplied by the Town's sources for each month from 2008 to 2011. As shown in **Chart 4-6**, water supply increases significantly during summer months, primarily due to lawn watering. The Town's highest water use typically occurs in July and August. Water production from the Mashel River is added to the system to meet the additional demand during these peak periods, as shown in **Chart 4-7**.

Table 4-4
2011 Demands by Pressure Zone

Pressure Zone	2011 Master Meter Supply (gallons)	Average Daily Demand (gpm)	Percent of Total Demand (%)
996	81,269,325	155	84.9%
1050	10,270,357	20	10.7%
1077	4,173,318	8	4.4%
Total	95,713,000	182	100%

Chart 4-6
Historical Monthly Water Supply

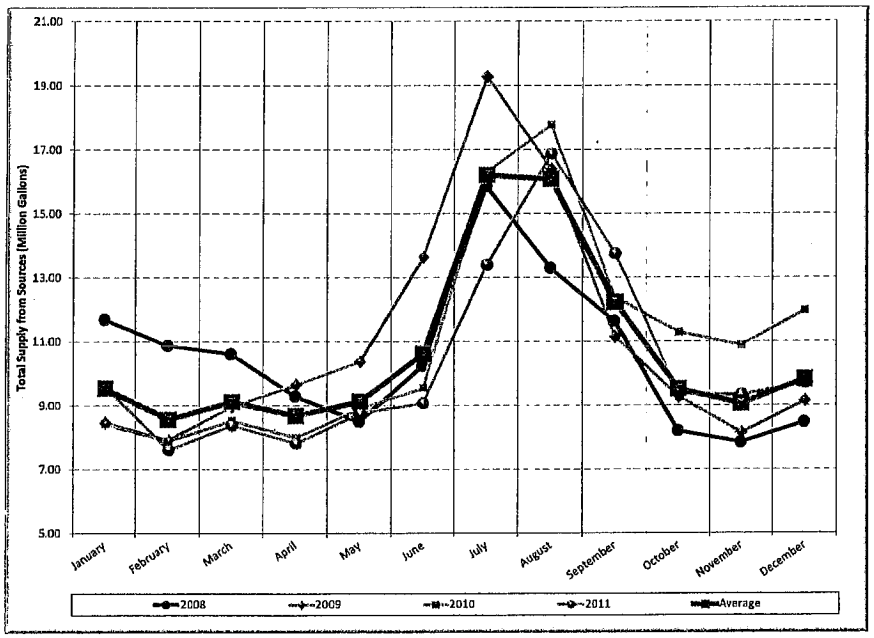
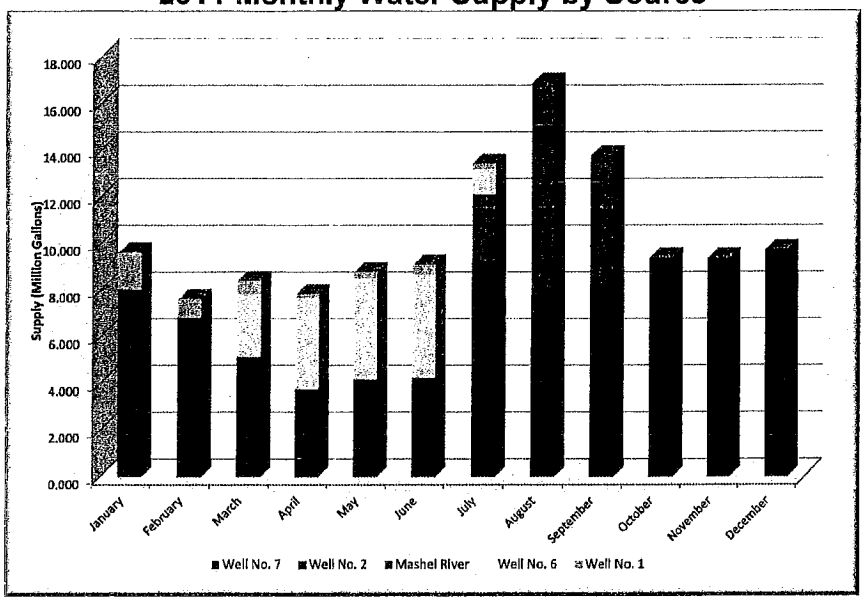


Chart 4-7
2011 Monthly Water Supply by Source



Distribution System Leakage

The difference between the amount of water supply and water consumption is the amount of distribution system leakage (DSL). The amount of DSL in a water system is calculated as the difference between the amount of water supply and the amount of authorized water consumption. There are many sources of DSL in a typical water system, including water system leaks; inaccurate supply metering; inaccurate customer metering; illegal water system connections or water use; fire hydrant usage; water main flushing; and well backwash and malfunctioning telemetry and control equipment resulting in reservoir overflows. Several of these types of usages, such as water main flushing, fire hydrant usage, and well backwash, may be considered authorized uses if they are tracked and estimated. Although real losses from the distribution system, such as reservoir overflows and leaking water mains, should be tracked for accounting purposes, these losses must be considered leakage. The Water Use Efficiency (WUE) Rule, which became effective in 2007, established a DSL standard of 10 percent of less based on a 3 year average.

Table 4-5 reports the total system leakage and the distribution system leakage for 2008 through 2011. Total system leakage is based on the difference between the amount of water supplied by the sources and the total authorized consumption. The rolling 3-year average for total system leakage in 2011 was approximately 31 percent. Distribution system leakage is based on the difference between the amount supplied by the master meter after the supply water is treated and the total authorized consumption after the master meter. The rolling 3-year average for DSL in 2011 was approximately 16 percent.

The total supply production and the total master meter supply differ by approximately 28 million gallons (MG) per year resulting in the two different leakage rates. Approximately 4.5 MG of the

28 MG is authorized consumption utilized in the treatment process for backwash, filter cleaning, and water quality testing. A portion of the leakage at the water treatment plant (WTP) site is due to known clear well leaks. The Town plans to further investigate the clear well leakage and locate any on-site leakage as a capital improvement project, which is identified in **Chapter 9**. The total production and total system leakage will be utilized for projecting demands and water system analyses.

Table 4-5
Distribution System Leakage

	2008	2009	2010	2011
Authorized Consumption (AC)				
Metered Customer Use (1,000 gal)	85,608	91,367	82,196	80,034
Construction/Hydrant Meter Use (1,000 gal)	102	102	16	322
Fire Department Usage (1,000 gal)	241	79	126	93
Hydroseeding (1,000 gal)	7	1	2	0
Flushing (1,000 gal)	20	174	0	0
Treatment Plant Water Usage (1,000 gal)	4,563	4,563	4,563	4,563
Total Authorized Consumption (1,000 gal)	90,541	96,284	86,902	85,010
Total Production (TP)				
Total Production (1,000 gal)	126,539	132,585	132,098	123,773
Total System Leakage (TP - AC)				
Total System Leakage (1,000 gal)	35,998	36,301	45,196	38,763
Total System Leakage (%)	28.4%	27.4%	34.2%	31.3%
Rolling 3-Year Average DSL (%)	28%	28%	30%	31%
Total Master Meter Supply (TMM)				
Total Master Meter Supply (1,000 gal)	103,892	105,346	102,055	95,713
Distribution System Leakage (TMM - AC) [1]				
Total Distribution System Leakage (1,000 gal)	17,914	13,625	19,715	15,265
Total Distribution System Leakage (%)	17.2%	12.9%	19.3%	15.9%
Rolling 3-Year Average DSL (%)	17%	15%	16%	16%

1 = AC in the DSL equation does not include "treatment plant water usage" since the water is utilized prior to the master meter.

The amount of DSL in the Town's distribution system has been as low as 12.9 percent in 2009 and as high as 19.3 percent in 2010. Although earlier years are not shown in **Table 4-5**, the Town experienced DSL as high as 26 percent in 2007. Thus, the Town has managed to decrease DSL in the system by repairing water main leaks and reducing the usage of non-metered water for construction projects. The DSL percentage is utilized for compliance with the WUE requirements.

The Town plans to decrease the amount of DSL by performing more leak detection on its system and repairing the leaks found to reduce the amount of water lost. The Town will continue to record the water used for construction, flushing, and fire department uses. The Town will also implement the WUE Program contained in **Appendix F**.

Equivalent Residential Units

The demand of each customer class can be expressed in terms of equivalent residential units (ERU's) for demand forecasting and planning purposes. One ERU is equivalent to the amount of water used by a single-family residence. The number of ERU's represented by the demand of the other customer classes is determined from the total demand of the customer class and the unit demand per ERU from the single-family residential demand data.

Table 4-6 presents the computed number of ERU's for each customer class for 2008 through 2011 for the Town's service area. The demands shown are based on supply data that was computed from the consumption of each class and the average amount of total system DSL from each year. The demand per ERU for 2011 was 274 gpd. This lies in the typical range of between 250 and 300 gpd for single-family demand in the Puget Sound area.

Table 4-6
Equivalent Residential Units (ERU's)

Year	Average Number of Connections	Average Annual Demand (gallons)	Demand per ERU (gal/day/ERU)	Total ERU's
Single Family Residential (ERU Basis)				
2008	865	89,408,312	283	865
2009	881	96,164,349	299	881
2010	874	94,770,817	297	874
2011	870	87,053,778	274	870
Multi-Family Residential, Schools, Commercial, Other				
2008	161	37,130,688	283	359
2009	156	36,420,651	299	334
2010	157	37,327,183	297	344
2011	160	36,719,222	274	367
Fire Sprinklers, Hydrants				
2008	6	0	283	0
2009	6	0	299	0
2010	6	0	297	0
2011	6	0	274	0
System-Wide Totals				
2008	1,032	126,539,000	283	1,225
2009	1,043	132,585,000	299	1,215
2010	1,037	132,098,000	297	1,218
2011	1,036	123,773,000	274	1,237

Average Day Demand

Average Day Demand (ADD) is the total amount of water delivered to the system in a year divided by the number of days in the year. The ADD is determined from historical water use patterns of the system and can be used to project future demand within the system. ADD data is typically used to determine standby storage requirements for water systems. Standby storage is the volume of a reservoir used to provide water supply under emergency conditions when supply facilities are out of service. Water production records from the Town's sources were reviewed to determine the system's ADD. The system's ADD from 2004 through 2011 is shown in **Table 4-3**.

Peak Day Demand

Peak Day Demand (PDD) is the maximum amount of water used throughout the system during a 24-hour time period of a given year. PDD typically occurs on a hot summer day when lawn watering is occurring throughout much of the system. In accordance with *WAC 246-290-230 - Distribution Systems,* the distribution system shall provide fire flow at a minimum pressure of 20 psi during maximum day demand (i.e., peak day demand) conditions. Supply facilities (wells, springs, pump stations, interties) are typically designed to supply water at a rate that is equal to or greater than the system's PDD.

The PDD is typically determined from the combined flow of water into the system from all supply sources and reservoirs on the peak day. The Town's PDD likely occurred during the week of July 31, 2009 when the sources of supply experienced a peak supply rate of 587 gpm and temperatures approached 90 degrees Fahrenheit in the Town. While the Town's daily supply information is available for that week, the reservoir flow data is not available; therefore, the system's PDD could not be computed based on actual system data. Instead, a typical PDD/ADD factor for the Puget Sound region of 2.50 was applied to the system's actual ADD. This resulted in an estimated PDD of 631 gpm for the peak day in 2009 as shown in **Table 4-7**.

Peak Hour Demand

Peak Hour Demand (PHD) is the maximum amount of water used throughout the system, excluding fire flow, during a 1 hour time period of a given year. In accordance with *WAC 246-290-230 - Distribution Systems*, new public water systems or additions to existing systems shall be designed to provide domestic water at a minimum pressure of 30 psi during PHD conditions. Equalizing storage requirements are typically based on PHD data.

The PHD, like the PDD, is typically determined from the combined flow of water into the system from all supply sources and reservoirs. Hourly water production records and chart recordings of reservoir levels were not available for the Town's supply and storage facilities. Therefore, the system's PHD could not be computed based on actual system data. Instead, it was estimated by applying a typical PHD/PDD ratio of 1.80 to the system's estimated PDD amount. This resulted in an estimated PHD of 1,135 gpm for the peak hour as shown in **Table 4-8**.

Table 4-7 also shows the peaking factors of the water system based on the ADD, PDD, and PHD data presented above. The PDD/ADD ratio of 2.50 is within the typical range of 1.2 to 2.5 for most systems. The estimated PHD/PDD ratio of 1.8 is within the typical range of 1.3 to 2.0 for most systems. These peaking factors will be used later in this chapter in conjunction with projected ADD to project future PDDs and PHDs of the system.

Table 4-7
Peak Day Demands and Peaking Factors

Peak Day Demand Data		
Demand Type	**Date**	**Demand (gpm)**
Average Day Demand (ADD)	2009	252
Peak Day Demand (PDD)	Daily reservoir data unavailable Assumed PDD/ADD = 2.50	631
Peak Hour Demand (PHD)	Hourly data unavailable Assumed PHD/PDD = 1.80	1,135
Peaking Factors		
Peak Day Demand/Average Day Demand (PDD/ADD) (typ. value assumed)		2.50
Peak Hour Demand/Peak Day Demand (PHD/PDD) (typ. value assumed)		1.80
Peak Hour Demand/Average Day Demand (PHD/ADD)		4.50

Fire Flow Demand

Fire flow demand is the amount of water required during fire fighting as defined by applicable codes. Fire flow requirements are established for individual buildings and expressed in terms of flow rate (gpm) and flow duration (hours). Fighting fires imposes the greatest demand on the water system because a high rate of water must be supplied over a short period of time, requiring each component of the system to be properly sized and configured to operate at its optimal condition. Adequate storage and supply is useless if the transmission or distribution system cannot deliver water at the required rate and pressure necessary to extinguish a fire.

General fire flow requirements were established for the different land use categories to provide a target level of service for planning and sizing future water facilities in areas that are not fully developed. The general fire flow requirement for each land use category is shown in **Table 4-8**. The water system analyses presented in **Chapter 7** are based on an evaluation of the water system for providing sufficient fire flow in accordance with these general fire flow requirements. The fire flow requirements shown in the table do not necessarily equate to actual existing or future fire flow requirements for all buildings, since this is typically based on building size, construction type, and fire suppression systems provided. Improvements to increase the available fire flow to meet actual fire flow requirements greater than those shown in the table shall be the responsibility of the developer.

Table 4-8
General Fire Flow Requirements

Land Use Category	Fire Flow Requirement (gpm)	Flow Duration (hours)
Single Family Residential	1,000	2
Multi-Family Residential	2,500	2
Commercial/Business Park	2,500	3
Industrial/Airport	2,500	3
Schools	2,500	3

FUTURE WATER DEMANDS

Basis for Projecting Demands

Future demands were calculated from the results of the existing per capita demand computations shown in **Table 4-3** and the projected population data from **Chapter 3**. Future demand projections were computed with and without water savings expected from implementing WUE measures contained in the Town's WUE Program in **Appendix F**. The calculated future per capita demand of 128 gpd was used for all demand projections without savings from WUE measures. The per capita demand was reduced to reflect the WUE goals and used as the basis for future water demand projections with implementation of the WUE Program. The Town's WUE Program presents a goal to reduce the 4-year rolling average demand per capita by 6 percent by the year 2018 and by 8 percent by the year 2032.

Future demands for the hydraulic model were calculated from the results of the total master meter supply data shown in **Table 4-4**. Differences between the master meter supply and per capita demand is discussed earlier in this chapter.

Demand Forecasts and Conservation

Table 4-9 presents the 1-year, 2-year, 3-year, 4-year, 5-year, 6-year, and 20-year water demand forecasts for the Town's water system. The actual demand data from 2011 and the estimated demand for 2012 are also shown in the table for comparison purposes. The future ADDs were projected based on population estimates for the given years and the estimated demand per capita values. The future PDDs and PHDs shown were computed from the projected ADDs and the existing system peaking factors shown in **Table 4-7**. The future demand projections are also shown with and without estimated reductions in water use from achieving WUE goals.

The analysis and evaluation of the existing water system with proposed improvements, as presented in **Chapters 7** and **9**, is based on the 20-year projected demand data without WUE reductions. This ensures that the future system will be sized properly to meet all requirements, whether or not

additional water use reductions are achieved. However, the Town will continue to pursue reductions in water use by implementing the WUE Program contained in **Appendix F** of this WSP.

Table 4-10 presents the existing and projected ERU's of the system. The 6-year and 20-year ERU forecast is based on the projected water demand data. The historical and projected water demand and ERU data from **Tables 4-9** and **4-10** are also shown graphically in **Chart 4-8**.

Table 4-9
Future Water Demand Projections

Description	2011 Actual [1]	2012 Projected	2013 Projected (+ 1 yrs)	2014 Projected (+ 2 yrs)	2015 Projected (+ 3 yrs)	2016 Projected (+ 4 yrs)	2017 Projected (+ 5 yrs)	2018 Projected (+ 6 yrs)	2019 Projected (+7 years)	2032 Projected (+ 20 yrs)
Population Data										
Population Served [2]	2,835	2,845	2,852	2,908	2,979	3,067	3,172	3,296	3,498	5,830
Increase from Base Year 2011		10	17	73	144	232	337	461	663	2,995
Demand Basis Data (gal/day/capita)										
Avg Day Demand without WUE	120	128	128	128	128	128	128	128	128	128
Avg Day Demand with WUE			127	125	124	123	122	120	120	118
Average Day Demand (gpm)										
Demand without WUE	235	253	254	258	265	273	282	293	311	518
Demand with WUE			251	253	257	262	268	275	292	477
Peak Day Demand (gpm)										
Demand without WUE	589	632	634	646	662	681	705	733	777	1,296
Demand with WUE			627	633	642	654	670	689	730	1,192
Peak Hour Demand (gpm)										
Demand without WUE	1,060	1,138	1,141	1,163	1,192	1,227	1,269	1,319	1,399	2,332
Demand with WUE			1,129	1,140	1,156	1,178	1,205	1,239	1,313	2,146

1 = 2011 Peak Day Demand and Peak Hour Demand values are based on the actual Average Day Demand amounts for the year and estimated peaking factors, and do not necessarily represent actual peak demands for this year.
2 = Population Served is the estimated Town population plus an estimated 60 customers outside of the Town limits.

Table 4-10
Future ERU Projections

Description	Actual	Projected								
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2032
Demand Data (gpm)										
Avg Day Demand without WUE	235	253	254	258	265	273	282	293	311	518
ERU Basis Data (gal/day/ERU)										
Demand per ERU without WUE	274	289	289	289	289	289	289	289	289	289
Demand per ERU with WUE		288	285	283	280	277	274	271	271	265
Equivalent Residential Units (ERUs)										
Total System ERUs	1,237	1,259	1,262	1,287	1,318	1,357	1,404	1,459	1,548	2,580

Chart 4-8
Future Water Demand and ERU Projections